

A Revision of the Fern Genus *Niphidium*¹

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#0021575

In the "Index Filicum" Carl Christensen hazarded a guess that the several supposed species of *Polypodium* subg. *Anaxetum* were but one species, *P. crassifolium* L. The members of this subgenus all have simple, elongate fronds with but a single row of sori between the principal side veins. Prior to Christensen, Fée, Raddi, Rosenstock, and Willdenow had named species that are not distinguishable from *P. crassifolium*. On the other hand, I have concluded that Cavanilles, Kunze, Mettenius, and Rosenstock did name valid species, and I have distinguished five more new species.

What led me into this revision was a routine identification for the National Institutes of Health anti-cancer drug screening program. I was asked to identify a specimen from Ecuador that appeared at first glance to be *P. crassifolium*. But careful study showed it to be a different species. Examination of all of the South American specimens of subg. *Anaxetum* revealed many that could not be included in *P. crassifolium*. Mr. C. V. Morton called to my attention the Ecuadorian species usually known as *Niphidium americanum*. It is clearly related to the other species of this group. Because it bears the oldest available generic name, *Niphidium* takes precedence over *Pessopteris* when these species are considered a distinct genus.

The genus *Niphidium* is distinct from *Polypodium* and its subgenera or generic segregates *Microgramma*, *Microsorium*, *Phlebodium*, and *Pleopeltis* in two characters. The sori are in one series between straight, well-defined lateral veins. The sori appear compital, but in fact an irregular ring of vascular tissue underlies the receptacle (Fig. 13). All the species of *Niphidium* have rather similar rhizome scales (Figs. 1-10), large, simple fronds with similar venation patterns, and smooth, monolet spores.

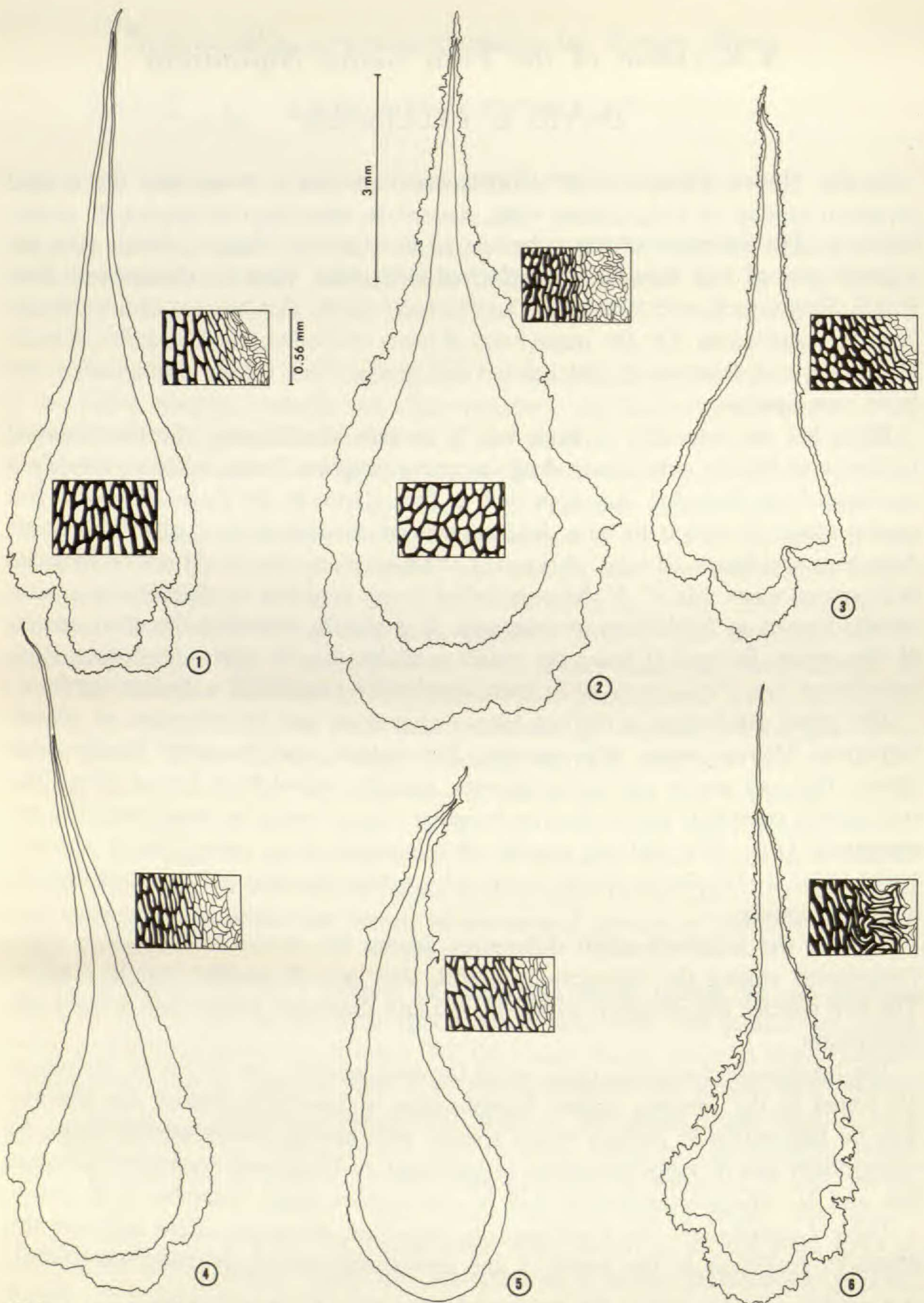
Because the relatively slight differences among the species of *Niphidium* make comparison among the descriptions useful, they are all parallel and in English. The new species are provided with a mere Latin diagnosis, rather than a full Latin description.

The taxonomic characters most useful for distinguishing the species of *Niphidium* are found in the rhizome scales. Identification of specimens lacking the rhizome may be impossible in regions where species with similar fronds overlap (e.g., *N. crassifolium* and *N. rufosquamatum* in southeastern Brazil and northeastern Argentina and *N. albopunctatissimum* and *N. crassifolium* from Colombia to Bolivia).

Table I summarizes the evolutionarily important characters. Zero indicates the primitive condition in the genus, 1 the specialized, and 2 the super-specialized.

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Rhizome scales of *Niphidium*. FIG. 1. *N. crassifolium*. FIG. 2. *N. albopunctatissimum*. FIG. 3. *N. nidulare*. FIG. 4. *N. carinatum*. FIG. 5. *N. rufosquamatum*. FIG. 6. *N. mortonianum*.

The sequences are believed to be correct because the evolutionary ground plan pattern (*Fig. 14*) is parsimonious. The letters indicate the characters and the numbers the amount of advancement of the characteristics. The smaller, unnumbered dots lack names and are hypothetical species.

Of the ten species of *Niphidium*, seven are Andean. One is from Costa Rica, and another is from southeastern Brazil and northeastern Argentina. *Niphidium crassifolium* is the only widespread species; it is found throughout tropical America. It is also an unspecialized species, although probably it is not the ground plan ancestor of the group.

Niphidium crassifolium is predominantly epiphytic, but is epipetric or terrestrial occasionally, particularly at its upper altitudinal limit. *Niphidium anocarpos*, *N. nidulare*, and *N. rufosquamatum* are also usually epiphytic. *Niphidium carinatum* is equally epiphytic or epipetric. The other five species (all Andean) are epipetric or terrestrial, and only rarely or occasionally epiphytic.

I found one name to exclude: *Polypodium crassifolium* f. *angustissimum* Rosent. (*Mém. Soc. Neuchat.* 5: 45. 1913), which is *P. angustifolium* Swartz.

***Niphidium* J. Smith, Hist. Fil. 99. 1875.**

Anaxetum Schott, *Gen. Fil. t. 1.* 1834, nec *Anaxeton* Gaertn. *Fruct.* 2: 406. 1791, nec *Anaxeton* Schrank, *Denkschr. Akad. München* 8: 146, 162. 1824 (both *Compositae*). TYPE (and sole original species): *Polypodium crassifolium* L. [= *Anaxetum crassifolium* (L.) Schott].

Phymatodes sect. *Pleuridium* Presl, *Tent. Pterid.* 196. 1836. LECTOTYPE: *Polypodium crassifolium* L. [= *Phymatodes crassifolia* (L.) Presl], chosen by J. Smith (*Hist. Fil.* 94. 1875).

Pleuridium (Presl) Fée, *Gen. Fil.* 273. 1850-52 [1852], non Bridel, *Mant. Musc.* 10. 1819 (*Musci*).

Pessopteris Underw. & Maxon, *Contr. U. S. Nat. Herb.* 10: 485. 1908. TYPE (and sole species): *Polypodium crassifolium* L. [= *Pessopteris crassifolia* (L.) Underw. & Maxon].

Rhizomes short- to long-creeping, the younger portions densely covered with roots bearing a fine tomentum of root hairs, the older portions often without roots, dictyostelic, scaly, the scales lanceolate-acuminate, in some species narrowly so, concolorous to sharply bicolorous, attached near the base to almost centrally; stipes coarse, tan, scaly only at the base, usually 1-5 cm distant, articulate, the phyllo-podia obsolete to 1 cm long; laminae simple, narrowly elliptic-lanceolate to oblong, attenuate to long-attenuate at the base, rounded, acute, or acuminate at the apex, coriaceous, often glaucous, often white-dotted or with dark brown or black hydathodes above, sometimes with a few rhizome-type scales along midrib, the main veins straight, ascending, prominulous beneath, the secondary veins immersed, forming inconspicuous, irregular, transverse areolae with numerous minor areolae containing numerous excurrent and recurrent free veinlets; sori solitary in the major areolae, forming single rows of (3)5-12(15) sori between the main veins, appearing compital but the veins forming an irregular ring beneath the sorus, round or slightly oblong transversely between the main veins, superficial, the receptacle dark brown, paraphyses (abortive sporangia) sometimes numerous, sporangia sometimes with multicellular, hyaline, linear or slightly clavate hairs on the capsule, annulus (11)12-15 thickened cells; spores bilateral, hyaline, smooth, often empty in some species.

TYPE (and sole original species): *Polypodium americanum* Hook. [= *Niphidium longifolium* (Cav.) Morton & Lellinger].

10. Rhizome scales weakly bicolorous, pale brown in mass, thin and fragile, the central cells in the apical portion of the scale isodiametric, their lumina large; rhizomes conspicuously pruinose beneath the scales; laminae 3.5–6.5(8) cm broad (Peru & Bolivia)7. *N. macbridei*

1. *Niphidium crassifolium* (L.) Lellinger, comb. nov.

Fig. 1.

Polypodium crassifolium L. Sp. Pl 2: 1083. 1753. LECTOTYPE: Linnaeus' original description cites two phrase names from Petiver's "Pterigraphia Americana," 1712, both of which lack descriptions but which are accompanied by small, obviously identifiable figures with rather inadequate analyses. Petiver's *t. 6, f. 8*. ("Phyllitis maculata, amplissimo folio") is a redrawn, left-to-right transposition of the far superior *t. 123* in Plumier's "Tractatus de Filicibus Americanis," 1705. There is a full description of this plate by Plumier on p. 107, and the source of his specimen is "dans les forests de l'isle Saint Domingue, particulièrement dans celles du quartier de Léogane." Petiver's *t. 6, f. 1*. ("Phyllitis maculata breviori & crassiori folio") is a similarly redrawn transposition of *t. 142* in Plumier's "Tractatus," which is said on p. 122 to be based on a specimen collected ". . . sur le Morne de la Calebasse à la Martinique." The specimen of *P. crassifolium* in the Linnaean Herbarium must have been added after the publication of *P. crassifolium* and surely did not form part of the protologue, for Linnaeus himself misidentified this specimen as his own *P. phyllitidis*. I choose as the lectotype *t. 6, f. 1*. of Petiver's "Pterigraphia Americana," solely because the drawing of the capsule illustrates the hairs that are characteristic of about 90% of the West Indian specimens of this species that I have examined.

Polypodium porrectum Willd. Sp. Pl., ed. 4, 5: 161. 1810. TYPE: "Habitat in sylvis umbrosis ad Caracas," Venezuela, *Bredemeyer* (B-Hb. Willd. not seen photo by Tryon US, fragment US; isotype W).

Polypodium coriaceum Raddi, Opusc. Sci. Bol. 3: 286. 1819; Pl. Bras. 1: 16, *t. 25*. 1825, *nec* Swartz, 1788, Roxb., 1844, Mett., 1857, *non* Kuhn, 1868. TYPE: "Invenitur in veteribus truncis arborum, nec non in rupibus umbrosis montium estrellensium, praesertim Corco-secco," Brazil, *Raddi* (PI, labelled "Polyp: coriaceum nob: e Brasilia").

Anaxetum crassifolium (L.) Schott, Gen. Pl. 1. 1834, *nom. illeg.*

Phymatodes crassifolia (L.) Presl, Tent. Pterid. 197. 1836.

Phyamtodes porrecta (Willd.) Presl, Tent. Pterid. 197. 1836.

Drynaria crassifolia (L.) J. Smith, J. Bot. 4: 61. 1841.

Dipteris crassifolia (L.) J. Smith, London J. Bot. 1: 196. 1842.

Pleuridium crassifolium (L.) Fée, Gen. Fil. 274. 1852, *nom. illeg.*

Pleuridium augustum Fée, Mém. Foug. 8: 98. 1857, *nom. illeg.* TYPE: "Nouvelle-Grenade dans les forêts de la province d'Ocaña," Depto. Norte de Santander, Colombia, ca 2400 m, *Schlim 610* (BR; isotypes HB, L, W).

Pleopeltis crassifolia (L.) Moore, Ind. Fil. LXXVIII. 1857.

Polypodium crassifolium f. *genuinum* Hieron. Bot. Jahrb. Engler 34: 538. 1904, as "genuina."

Pessopteris crassifolia (L.) Underw. & Maxon, Contr. U. S. Nat. Herb. 10: 485. 1908.

Rhizomes creeping, (5)8–12 mm in diam, rarely pruinose, phyllopodia 5 mm long, 3–5 mm wide; rhizome scales lanceolate-acuminate, ca 8–12 mm long, 2.5–4 mm wide, plane throughout, usually strongly bicolorous, the central band blackish, the cells usually strongly clathrate, those above the base (2)3–5 × longer than wide, the margins pale tan, entire or slightly repand, sometimes erose in age, up to 0.5 mm wide at the base, 0.15 mm wide toward the apex, the cells elongate toward the apex. Stipes 5–15(50) cm long, 3–5(9) mm in diam, adaxially flattened or sulcate. Laminae usually narrowly oblanceolate, sometimes narrowly lanceolate, the juveniles linear-lanceolate, attenuate or acuminate at the base, acute to rounded (sometimes with a small, acuminate tip) at the apex, (30)45–80(105) cm long, 6–11(18) cm wide, dark green above

in life, brown and often glaucous above when dry, with brown hydathodes, paler beneath; midrib scales up to 2 mm long, 0.75 mm wide, like those of the rhizome, caducous, seldom seen; principal veins 5–8(12) mm distant, closer in juvenile and partially developed fronds; sori round or slightly elongate transversely in the largest specimens, 1.5–3.5(5) mm in diam; sporangia with up to 10 deciduous, linear to slightly clavate, (1)2-celled hairs on the capsule; paraphyses (abortive sporangia) usually common among the sporangia; empty spores common.

RANGE AND HABITAT: Tropical America. Epiphytic (occasionally epipetric, terrestrial, or on old walls) at all forested altitudes, but mostly below 1500 m.

Specimens lacking rhizome scales or with old and badly eroded scales cannot be distinguished readily from *N. rufosquamatum* and *N. albopunctatissimum*. Such specimens have been annotated *N. crassifolium sensu lato*. I have found no character beyond the rhizome scales that distinguishes *N. crassifolium* from *N. rufosquamatum*. Habitat is a fairly reliable differentiating character between *N. albopunctatissimum* and *N. crassifolium*. The former species is terrestrial or epipetric about 95% of the time and epiphytic only 5%. But this difference is less reliable for *N. crassifolium*, which is epiphytic about 88% of the time and not 12%. In contrast to *N. crassifolium*, *N. albopunctatissimum* usually is white-dotted above. This is the basis for Linden's invalidly published epithet that was taken up by J. Smith (Ferns Brit. & For. 95. 1866). The sporangial hairs I have examined of *N. crassifolium* are 1(2)-celled, whereas those of *N. albopunctatissimum* are (2)3-celled; this difference is not entirely diagnostic or consistent.

The rhizome scales of *N. crassifolium* are very uniform throughout the Antilles and Central America, but in South America some are less strongly lanceolate because their pale margins are somewhat broader. This makes separating some specimens of *N. crassifolium* from *N. albopunctatissimum* a little difficult, particularly when the rhizome scales are not in good condition.

The root mass of *N. crassifolium* has been recorded as housing a colony of huge, fierce ants (Nicaragua, *Bunting & Licht 1248*), and the plant is said to be the host of the fungus *Caliciopsis maxima* (B. & C.) Höhnd. (Costa Rica, *Alfaro 71*).

REPRESENTATIVE SPECIMENS EXAMINED:

CUBA: Pinar del Río: N of San Diego de los Baños, *Palmer & Riley 639* (US). Las Villas: Trinidad Mountains, Río Negro, Arroyo Trinitario, 550 m, *Britton & Britton 5171* (NY). Oriente: Near Monte Verde, *Wright 1022* (L, LE, NY, US); Near Jagüey, 800 m, *Eggers 4952* (F, NY, US). **JAMAICA:** Morces Gap, 500 ft, *Clute 70* (NY, US); Hermitage Dam and vicinity, 500 m, *Maxon 8822* (GH, US); Cooks Bottom, N of Ipswich, 400–450 m, *Maxon & Killip 1446* (F, GH, NY, US). **HISPANIOLA:** Haiti: Massif de la Selle, Croix-des-Bouquets, ca 1500 m, *Ekman III H7782* (F, NY, US); Vicinity of Mission, Fonds Varettes, ca 1000 m, *Leonard 3937* (GH, US). Dominican Republic: Montaña Nueva, SE of Polo, 3500 ft, *Howard & Howard 8537* (GH, NY); San José de las Matas, Jiconié, 625 m, *Valeur 308* (F, L, NY, US). **PORTO RICO:** 13 mi N of Cayey on military road, *Underwood & Griggs 284* (NY, US); Alto de la Bandera, near Adjuntas, *Britton & Shafer 2078* (F, NY, US). **LESSER ANTILLES:** St. Croix: *Hornemann* in 1837 (LE). Saba: 23 Apr 1885, *Suringar* (L, US). Montserrat: Woodlands Mountain, *Shafer 578* (F, NY, US). Guadeloupe: Bois des Vieux-Habitants, 200–700 m, *Düсс 4096* (F, GH, NY, US). **Dominica:**

Lisdara, 457 m, *Hodge 33* (GH, NY, US); W side of steep hill behind Sylvania Estate, 2200 ft, *Lellinger 421* (BM, GH, IJ, ISC, LP, TRIN, US). **Martinique:** *Sieber 351* (LE, NY); *Düss 1671* (NY, US). **St. Lucia:** Savanne Edmund district, SE of Piton Troumassée, 1800–2000 ft, *Proctor 17954* (GH). **St. Vincent:** Along Chateaubelair River, 300–400 m, *Morton 5204* (US). **Barbados:** *Herb. Jenman* (NY). **Trinidad:** *Fendler 103* (GH, LE, NY, US); Tahaquite, 12 Oct 1918, *Broadway* (F, NY, US).

MEXICO: **Querétaro:** *Arsène 10656* (US). **Veracruz:** Near Cerro Tapalcapan and Cerro Mastagata, NW of Catemaco, region of San Andrés Tuxtla, *Dressler & Jones 156* (F, GH, MICH, NY, US); Region of Orizaba, *Bourgeau 3606* (LE, NY, US). **Puebla:** Near Necaxa, *Sanchez M. 607* (US). **Oaxaca:** Valley of the Yelagago River, ca 20 mi NE of Villa Alta, ca 3800 ft, *Mickel 1013* (MICH, US). **Chiapas:** Volcán Tacana, 1400 m, *Matuda 2770* (F, MICH, NY, US). **GUATEMALA:** **El Petén:** Dos Arroyos to Yaloch, *Bartlett 12845* (MICH, US). **El Quiché:** Quiché, *Aguilar 787* (F). **Huehuetenango:** Maxbal, 1500 m, *Steyermark 48837* (F). **Alta Verapaz:** Cobán, 4300 ft, *von Türckheim 553* (US). **Izabal:** Vicinity of Quiriguá, 75–225 m, *Standley 24465* (GH, NY, US). **San Marcos:** Rodeo, 750 m, *Standley 68738* (F). **Quezaltenango:** *Muenschner 12124* (F). **Guatemala:** Guatemala City, 1500 m, *Steyermark 39874* (F). **Escuintla:** 540–720 m, *Standley 63364* (F). **BRITISH HONDURAS:** **El Cayo:** Mountain Pine Ridge, *Bartlett 13057* (MICH, US). **Toledo:** Near Jacinto Creek, 9 mi, Punta Gorda–San Antonio Road, *Gentle 4964* (US). **Stann Creek:** Middlesex, *Gentle 2841* (GH, MICH, NY, US); Big Creek, *Schipp 88* (F, GH, MICH, NY, US). **HONDURAS:** **Cortés:** Headwaters of the Río Lindo, 630 m, *Williams & Molina R. 11402* (F, US). **Comayagua:** Near El Achote, hills above the plains of Siguatepeque, 1350 m, *Yuncker et al. 6437* (MICH, US). **Francisco Morazán:** Mt. Uyuca, 5800 ft, *Glassman 2193* (F, NY). **Atlántida:** Foothills back of Ceiba, *Yuncker et al. 8005* (F, GH, NY). **NICARAGUA:** **Zelaya:** Vicinity of Bluefields, 0–60 m, *Bunting & Licht 1248* (F, GH, NY). **Matagalpa:** Santa María de Ostuma, 1300–1500 m, *L. O. Williams et al. 23622* (F, US). **Jinotega:** E of Jinotega, 1400–1500 m, *Standley 10008* (F). **Chontales:** La Libertad, 500–700 m, *Standley 9021* (F). **COSTA RICA:** **Guanacaste:** El Silencio de Tilarán, *Brenes 15652* (F, NY). **Puntarenas:** Río del Convento, Bassin du Diquís, 200 m, *Pittier 12099* (CR, US). **Alajuela:** Near San Ramón, *Tonduz 17575* (F, GH, US). **Limón:** Flot de la Uvita, Puerto Limón, *Pittier 12702* (CR, US). **Heredia:** Near Cariblanco, near the Río Sarapiquí, 800 m, *L. O. Williams 20328* (EAP, US). **San José:** Vicinity of El General, 880 m, *Skutch 2954* (GH, NY, US). **Cartago:** El Alto, near the continental divide, 5100 ft, *Stork 1081* (MICH, US). **PANAMA:** **Bocas del Toro:** Río Cricamola between Finca St. Louis and Konkintoë, ca 10–50 m, *Woodson et al. 1885* (GH, NY, US). **Chiriquí:** Forests around El Boquete, 1000–1300 m, *Pittier 2971* (US). **Coclé:** Hills NE of El Valle de Antón, 2000 ft, *Lewis et al. 1700* (GH, MO, US). **Canal Zone:** Barro Colorado Island, *Shattuck 58, 383* (both F, US). **Colón:** Vicinity of Porto Bello, 5–200 m, *Maxon 5783* (GH, NY, US). **Panamá:** Cerro Campana, *Bartlett & Lasser 16927* (GH, MICH). **Darién:** Vicinity of Cana, 2500 ft, *Stern et al. 553* (GH, US).

VENEZUELA: **Distrito Federal:** S slope of Cerro Avila, 1800 m, *Vogl 60* (F). **Lara:** Río Calro, *Santiago 47* (F). **Mérida:** Near Colonia Tovar, *Fendler 223* (GH, MO, NY). **Bolívar:** Cerro Guaiquinima, Río Paragua, 1100 m, *Maguire 33129* (F, NY). **COLOMBIA:** **Magdalena:** Las Partidas, 3500 ft, *H. H. Smith 1039* (F, MICH, NY, US). **Bolívar:** Lands of Loba, Norosi–Tiquisio trail, 150–600 m, *Curran 133* (GH, NY, US). **Cundinamarca:** Below Tausa, ca 22 km NE of Zipaquirá, 2750 m, *Tryon & Tryon 6154* (GH), **Meta:** Río Güejar ca 10 km below junction with Río Zanza, 470 m, *Smith & Idrobo 1519* (GH, UC, US). **Vaupés:** Río Papurí, mountain below Teresita, *Schultes & Cabrera 19479* (GH, US). **Huila:** Canyon of the Río de Las Ceibas, 25–40 km SE of Neiva, 6500 ft, *Little 9307* (US). **Antioquia:** 1 km E of the Turbo–Chigorodó road up the Río Vijagual, ca 100 m, *Feddema 2021* (US). **Chocó:** Lower Río Truando 3–12 km SSW of Riosucio, 2–4 m, *Lellinger & de la Sota 610* (COL, CR, LP, US). **Valle:** Río Calima between La Esperanza and Bellavista, 5–10 m, *Cuatrecasas 16801* (US). **Nariño:** Las Lajas, near Ipiates, *Balls*

B7364 (UC, US). **ECUADOR: Manabí:** Km 82, road from Chone to Pichincha, 450 m, *Dodson & Thien 1776* (MO, US). **Guayas:** Upper Río Guayas, *Rimbach 23* (GH, NY); 1–8 km N of Sevilla de Oro, 8000–9000 ft, *Camp E-4569* (F, GH, MO, NY, UC). **Carchí:** Near Angel, 3200–3300 m, *Mexia 7448* (GH, MICH, UC, US). **Imbabura:** Hacienda La Victoria, 2345 m, *Mexia 7425* (F). **Pichincha:** Vicinity of Quito, 2900 m, *Holdridge 1512* (NY, UC). **Los Rios:** Near Quevedo, ca 50 m, *Mexia 6614* (GH, UC, US). **Bolívar:** Limón, 800–1100 m, *Acosta Solís 6375* (F). **Loxa:** Cajanuma, 2400 ft, *Espinosa 357* (GH). **PERU: San Martín:** Jepelasio near Moyobamba, 890–1200 m, *Woytkowski 35322* (MO, UC). **Loreto:** Gamitanacocha Río Mazán, 100–125 m, *Schunke 286* (F, GH, NY, UC); Above Pongo de Manseriche, streamlet near mouth of the Río Santiago, 210 m, *Mexia 6195a* (F, GH, MO, NY, UC). **Huánuco:** Huánuco, Hacienda Mercedes, 1020 m, *Mexia 8223* (F). **Junín:** Río Paucartambo Valley, near Perene Bridge, 700 m, *Killip & Smith 25265* (NY, US). **Cuzco:** Machu Picchu, ca 2100 m, *Cook & Gilbert 864* (US). **BOLIVIA: La Paz:** North Yungas, Polo-Polo, near Coroico, 1100 m, *Buchtien 3539* (F, GH, NY, UC). **BRAZIL: Rondônia:** Rio Laje on road to Guajará-Mirim to Riberão, *Prance et al. 6740* (F). **Bahía:** Porto Seguro, Km 5 on BR-5, *Duarte & Brade 6735* (F, LP). **Minas Gerais:** Distrito Carangola, 3 leagues S of Areponga, trail to Areponga to Fazenda de Grama, 900 m, *Mexia 4227* (F, MO, NY). **Rio de Janeiro:** Friburgo, 30 Nov 1963, *Dunge* (LP). **São Paulo:** Alto de Serra, *Wackett 130* (UC). **SURINAME:** Tibiti Savanna, bank of the Tibiti River, *Kramer 1907* (US). **GUAYANA:** Watershed between the Rupununi and Kuyuwini Rivers, Parabarú Savanna, *A. C. Smith 3045* (F, GH, MO, NY).

2. *Niphidium albopunctatissimum* Lellinger, sp. nov.

Figs. 2 and 15.

Polypodium albopunctatissimum Linden, Cat. 1860, *nom. nud.* This name appears in a list of cultivated plants. There is no description.

Pleuridium albopunctatissimum J. Smith, Ferns Br. & For., ed. 1: 95. 1866, *nom. nud.* Apparently Linden distributed a living plant bearing the name *Polypodium albopunctatissimum* to Kew. I have seen an electrostatic copy of a specimen (BM) made in 1862 from such a cultivated plant bearing the name *Pleuridium albopunctatissimum* in J. Smith's own hand.

Polypodium crassifolium var. *longipes* Rosenst. Rep. Sp. Nov. Fedde 11: 58. 1912. TYPE: North Yungas, Unudavi, Prov. La Paz, Bolivia, 3300 m, *Buchtien 2757* [cited by Rosenstock as 2750] (S-PA Morton photo 20636 US; isotype US).

Ab *N. crassifolio* in margine squamarum rhizomatis repando, plus quam 0.3 mm lato, cellulis centralibus 1–2(3) × longiores quam latiores differt.

Rhizomes creeping, 8–10 mm in diam, often pruinose, phyllopodia 2–10 mm long, 3–5 mm wide, rhizome scales broadly lanceolate-acuminate, ca 7–10 mm long, 2–5 mm wide, plane and repand throughout, usually strongly bicolorous, the central band brownish, the cells usually strongly clathrate, those above the base 1–2(3) × longer than wide, the margins pale tan, up to 1.25 mm wide at the base, 0.5 mm wide at the apex, the cells not elongate toward the apex. Stipes 5–30(45) cm long or occasionally obsolete, (3)4–5 mm in diam, adaxially sulcate. Laminae linear-lanceolate, attenuate or acuminate at the base, acuminate or acute at the apex, (15)35–90 cm long, (3)7–11.5 cm wide, pale green above in life, brown above when dry with the hydathodes often encrusted with white deposits, paler beneath; midrib scales up to 3 mm long, 1.5 mm wide, like those of the rhizome, caducous, seldom seen; principal veins 5–7(8) mm distant, 0.5–1 mm closer in juvenile and partially developed fronds; sori round or slightly elongate transversely in the largest specimens, 2–4(5) mm in diam; sporangia with up to ca 10 deciduous, linear, 2(3)-celled hairs on the capsule; paraphyses (abortive sporangia) rare among the sporangia.

TYPE: Apolo, Prov. La Paz, Bolivia, 4800 ft, *R. S. Williams 1062* (NY; isotypes GH, US).

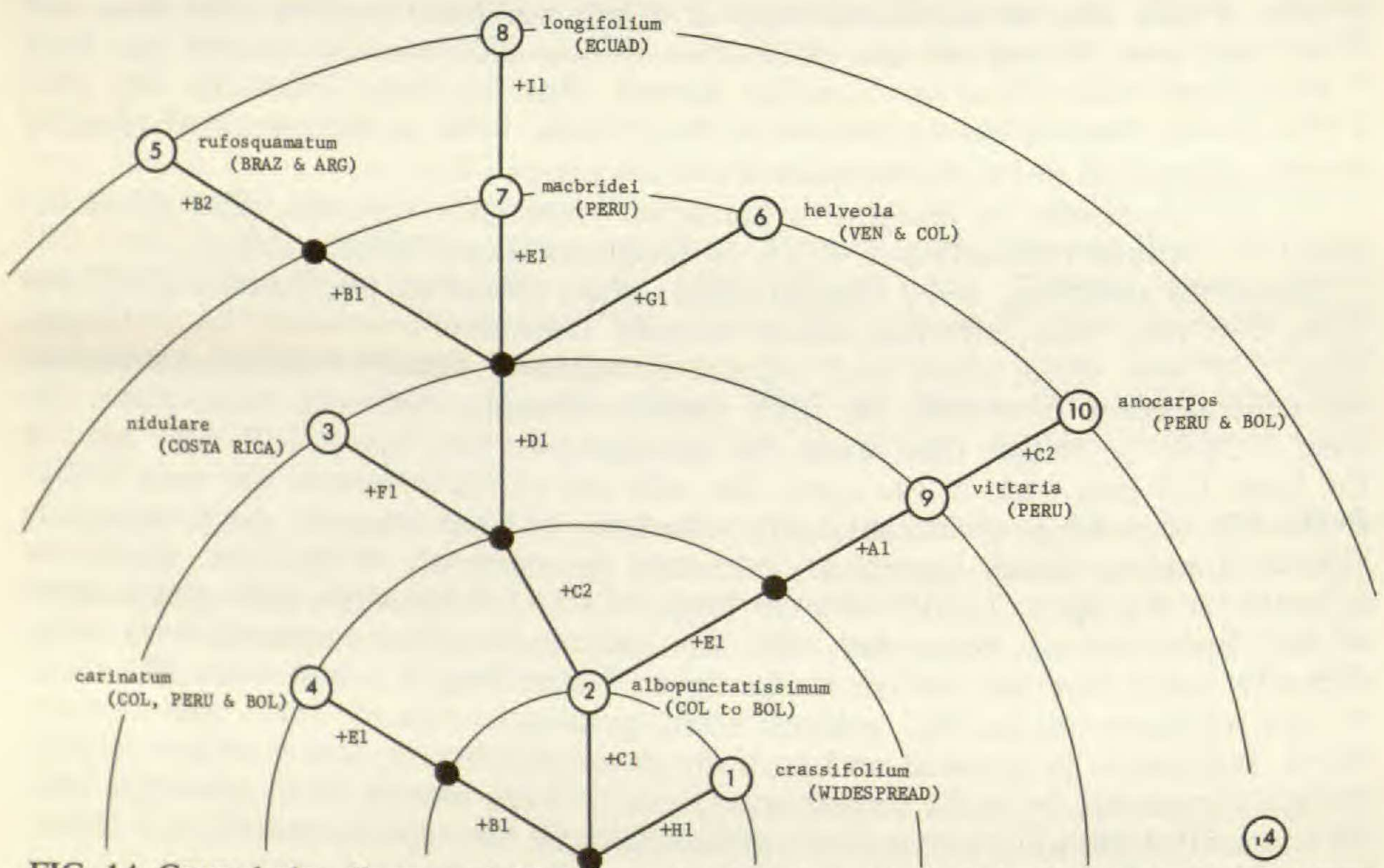
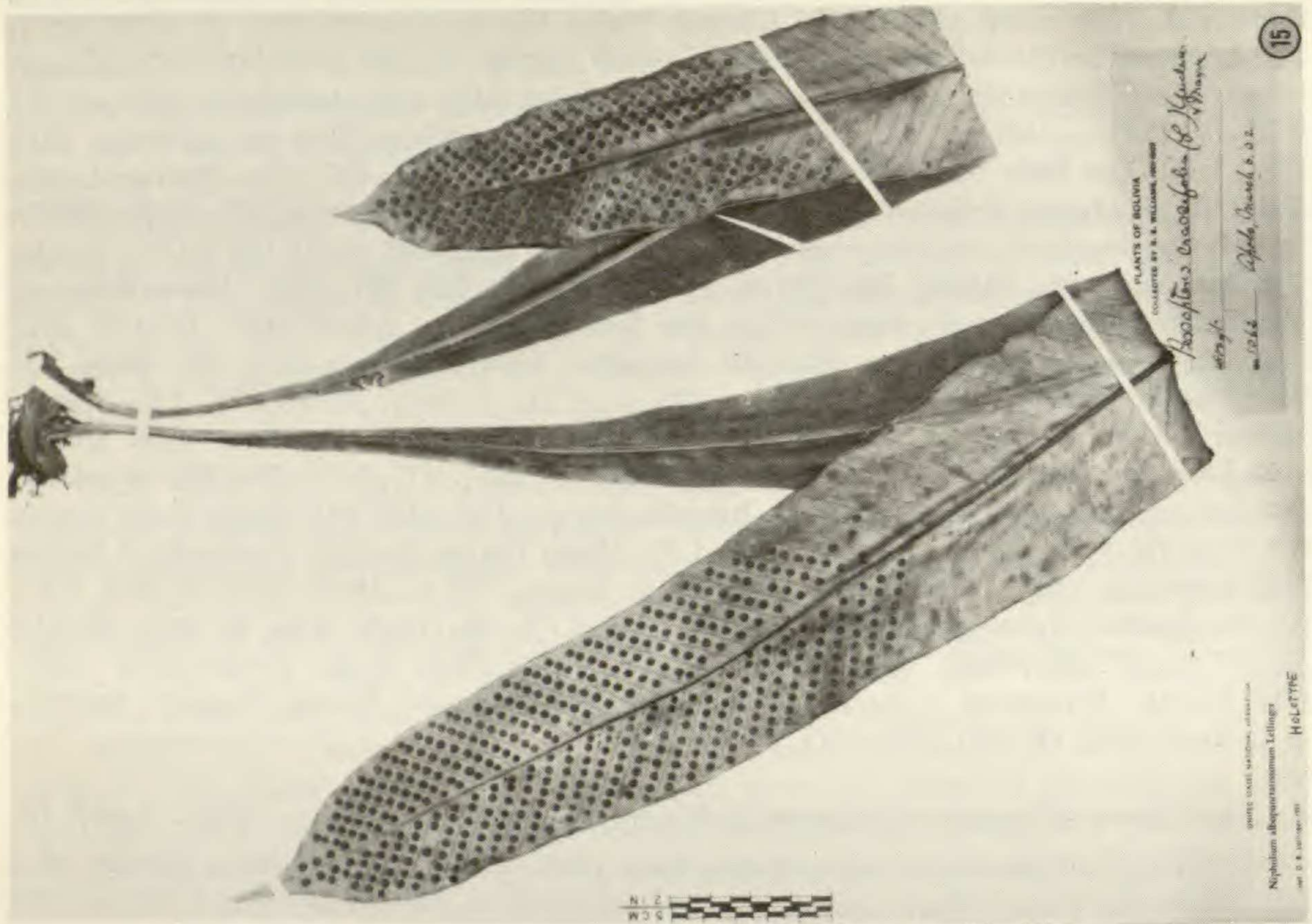


FIG. 14. Ground plan diagram of *Niphidium*. Explanation on pp. 101, 103. FIG. 15. Holotype of *Niphidium albopunctatissimum* (Williams 1062, NY).

RANGE AND HABITAT: Southern Colombia to southern Bolivia; in Peru and Bolivia mostly in the Cordillera Central and Cordillera Oriental. Terrestrial or epipetric, rarely epiphytic, at altitudes from (800)1800 m to 3300 m.

For comments on distinguishing *N. albopunctatissimum* from *N. crassifolium*, see the latter species. The pale green frond color may be due to bleaching in the strong sunlight of the exposed, terrestrial and epipetric habitat of this species,

TABLE I. CHARACTERS OF EVOLUTIONARY IMPORTANCE IN *NIPHIDIUM*

Characters	Characteristics										
		1 <i>N. crassifolium</i>	2 <i>N. albopunctatissimum</i>	3 <i>N. nidulare</i>	4 <i>N. carinatum</i>	5 <i>N. rufosquamatum</i>	6 <i>N. mortonianum</i>	7 <i>N. macbridei</i>	8 <i>N. longifolium</i>	9 <i>N. vittaria</i>	10 <i>N. anocarpos</i>
A. Rhizome thickness	5-15 mm (0) 3-5 mm (1)	0	0	0	0	0	0	0	0	1	1
B. Rhizome scale color	bicolorous (0) weakly bicol. (1) concolorous (2)	0	0	0	1	2	0	0	0	0	0
C. Rhizome scale margins	entire (0) repand or erose (1) toothed or ciliate (2)	0	1	2	0	2	2	2	2	1	2
D. Rhizome scale cell walls	not contorted (0) contorted (1)	0	0	0	0	1	1	1	1	0	0
E. Lamina width	≥5 cm (0) <5 cm (1)	0	0	0	1	0	0	1	1	1	1
F. Lamina base	attenuate to acute (0) obtuse to rounded (1)	0	0	1	0	0	0	0	0	0	0
G. Sporangium pedicels	not swollen (0) swollen (1)	0	0	0	0	0	1	0	0	0	0
H. Paraphyses in sori	few or none (0) many (1)	1	0	0	0	0	0	0	0	0	0
I. Lamina scales	absent or rare (0) abundant (1)	0	0	0	0	0	0	0	1	0	0

compared to the darker green fronds of the epiphytic *N. crassifolium*, which typically is at least partially shaded.

ADDITIONAL SPECIMENS EXAMINED:

COLOMBIA: Putumayo: E Slope of Cerro San Francisco, N fork of Río Afiladores, 2500 m, *Ewan 16254* (US). **Nariño:** Pasto, ca 2500 m, *Espinosa E-2756* (US). **ECUADOR:** **Carchí:** Between Cunquer and Cuesaca, 2650-2900 m, *Acosta Solís 10455* (F). **Pichincha:** Cerro Antisana, 2 mi SE of Borja, 5700 ft, *Grubb et al. 1198* (US); Mt. Pichincha, 2800 m, *Mille* in 1920 (US). **Tungurahua:** Mera, 1400 m, *Schimpff 664* (F); Vicinity of Patate, Hacienda Leito, 2650 m, *Asplund 8030* (US); Baños, 6000 ft, 6 Feb 1921, *Popenoe* (US); Mt. Tungurahua, 2000 m, *Rimbach 393* (F). **Chimborazo:** Eastern Riobamba, Chamba,

2800 m, *Schimpff* 792 (F, MO). **Cañar:** Near the village of San Marcos, 5–8 km NE of Azogues, *Camp E-2600* (NY, US). **Azuay:** Vicinity of Cuenca, *Rose* 22840 (GH, NY, US); Mountains above Sayaus, E of Cuenca, ca 300 m, *Correll E-362* (US); Cruz Pamba region above Baños, ca 15 km SW of Cuenca, 9000–10000 ft, *Camp E-3949* (NY, US); Páramo Alpacada, along the Pan-American Highway 82 km S of Cuenca, 9500 ft, *Wiggins* 10815 (MO, NY, US). **Loja:** Km 25 along the road from Loja to San Lucas, 2200 m, *Dodson & Thien* 562 (MO, US). **PERU:** **Piura:** Ayabaca, 2742 m, *Soukup* 4355 (US). **Cajamarca:** Huambos, 2000 m, *Soukup* 4487 (US). **Amazonas:** Middle and upper slopes of Puma-urcu, SE of Chachapoyas, 2500–2700 m, *Wurdack* 553 (F, US); Caño Santa Lucia just E of Chachapoyas, 2200–2300 m, *Wurdack* 742 (GH, NY, US). **San Martín:** 60 km NE of Tingo María, at the pass through Cerro Azul on the Tingo María–Pucallpa Road, 1500 m, *Tryon & Tryon* 5265 (GH). **La Libertad:** Near Chaullacocha, on the Trujillo–Otuzco Road, 8000 ft, *Saunders* 897 (GH). **Huánuco:** 2–4 km E of Huasahuasi, 2400–2500 m, *Hutchison* 1124 (F, US); Near Huasahuasi, below Tarma, 2600 m, *Correll & Smith P-773* (GH); Puacartambo, 2800 m, *Woytkowski* 6746 (US); Carpapata, *Künkel* 531 (GH); Between Palca and Carpapata, 2900 m, *Stork* [2nd U. C. Bot. Gard. Exped.] 10960 (F, UC, US); Manto, 29 km W of Yaupi, 1100 m, *Woytkowski* 6552 (US); Huacapistana, between Tarma and San Ramón, 1800 m, *Constance & Tovar* 2255 (UC); Villa Amoretti, *Künkel* 527 (GH); Tingo María, Río Huallaga, *Asplund* 12352 (US); Carpish, 2800 m, *Coronado* 58 (GH, UC); 15 mi NE of Huánuco, ca 10000 ft, *Macbride & Featherstone* 2148 (F, US); Mito, ca 9000 ft, *Macbride & Featherstone* 1387 (F, US); Muña, ca 7000 ft, *Bryan* 676 (US); Huacachi, estación near Muña, ca 6500 ft, *Macbride* 4081 (F, US). **Huancavelica:** Chuspi-Tocas, between Colcabamba and Paucarbamba, 2800 m, *Tovar* 2123 (GH). **Cuzco:** Between Mistiana and Keros, Valley of the Cosuipata, ca 800 m, *Scolnik* 885 (US); Intihuatana, 1800 m, *Herrera* 881 (US); Río Urubamba, 2050 m, *Angulo* 1785 (GH); Hacienda Amaibamba, 1650 m, *Scolnik* 802 (US). **Puno:** Near Tabina, *Lechler* 2042 (LE). **BOLIVIA:** **La Paz:** Near Soratá, Río Challasuyo, 2650–2750 m, *Mandon* 1566 (GH, LE, NY); Soratá, 7500 ft, *R. S. Williams* 1061 (NY, UC, US); Tusihuaya, Chulumani, Yungas, ca 1740 m, *Scolnik & Luti* 515 (US); Yungas, 6000 ft, *Rusby* 345 (F, MICH, NY, US); North Yungas, Milluguaya, *Buchtien* 5002 (US). **Cochabamba:** Incacorral, 2350 m, *Steinbach* 9687 (F, GH, MO, NY); Road to Todos Santos near Comercocha, 300 m, *Cárdenas & Cutler* 7376 (GH); Incachaca, 2500 m, *Steinbach* 5785 (F, GH, MO). **Santa Cruz:** Cerro Hosána, 1900 m, *Steinbach* 3401 (GH); Cordillera de Tucahuasi, 1700 m, *Cárdenas* 2862 (F). **Tarija:** Caripata, *Bang* 2142 (LE, MICH, MO, NY, US).

3. *Niphidium nidulare* (Rosenst.) Lellinger, comb. nov.

Fig. 3.

Polypodium crassifolium var. *nidulare* Rosenst. Repert. Sp. Nov. Fedde 22: 18. 1925. TYPE: La Palma, Prov. San José, Costa Rica, 1400 m, 14 Mar 1909, A. & C. Brade 113 (S-PA Morton photos 5969, 20635 US; isotopes B photos NY, US).

Rhizomes short-cheeping, 6–9 mm in diam, not pruinose, phyllopodia 1–2 mm long, 3–5 mm wide; rhizome scales lanceolate-attenuate, 6–8 mm long, 2.5–3 mm wide, plane throughout, weakly bicolorous, the central band blackish, the cells strongly clathrate, those above the base 1.5–3 × longer than wide, the margins brown, shallowly toothed, up to 0.5 mm wide at the base, 0.05 mm wide toward the apex, the cells elongate toward the apex. Stipes 0.5–1 cm long, 3–5 mm in diam, adaxially flattened or sulcate. Laminae narrowly lanceolate, the juveniles lanceolate, attenuate or not much narrowed below to an obtuse or rounded base, acute at the apex, (25)55–105 cm long, 3–6.5(9) cm wide, dark green above in life, brown and not glaucous above when dry, with inconspicuous hydathodes, slightly paler beneath; midrib scales not observed; principal veins (3)5–7(9) mm distant, closer in partially developed fronds; sori round or slightly elongate transversely, 2–3 mm in diam; sporangia with up to 5 deciduous, linear, 1-celled hairs on the capsule; paraphyses (abortive sporangia) rare among the sporangia.

RANGE AND HABITAT: Cordillera Central of Costa Rica. Epiphytic, at altitudes of 1300–1550 m.

This species is most closely related to *N. crassifolium* and *N. carinatum*, from which it is distinct in its toothed, blackish rhizome scales and in its fronds, which have an obtuse to rounded base with almost obsolete stipes.

ADDITIONAL SPECIMENS EXAMINED:

COSTA RICA: **Puntarenas:** Monteverde, *de la Sota* 5004 (LP). **Alajuela:** Zarcero, *A. Smith* 48/199 (US); Region of Zarcero, *A. Smith* F-40 (F). **San José:** Vicinity of La Palma, 1450–1550 m, *Maxon* 454 (US). **Cartago:** Navarro, 1500 m, *Torres R.* 42 (US); La Fortuna, between Cervantes and Pacayas, 1400 m, *Biolley* 23 (US); Between Turrialba and Cartago, 21 June 1874, *Hb. Kuntze* (NY); Orosi, ca 5000 ft, *Scamman* 6162 (GH); Estrella, 4400 ft, *Cooper* 6046 (US).

4. *Niphidium carinatum* Lellinger, sp. nov.

Figs. 4 and 16.

Ab *N. crassifolio* in squamis involutis rhizomatis, cellulis non valde clathratis, et in laminis angustis, usque ad 5.5(7.5) cm latis differt.

Rhizomes short-creeping, 6–8(10) mm in diam, not pruinose, phyllopodia 5–6 mm long, 3–4 mm wide; rhizome scales long lanceolate-acuminate, ca 8–10 mm long, 2.5 mm wide, carinate toward the apex, bicolorous, the central band brown to red-brown, the cells not strongly clathrate, the lumina obscured, those above the base 2–3 \times longer than wide, the margins pale tan, entire toward the apex, slightly repand near the base, 0.5 mm wide at the base, ca 0.1 mm wide toward the apex, the cells elongate toward the apex. Stipes obsolete to 5 cm long, 2–3 mm in diam, adaxially sulcate. Laminae linear-lanceolate, the juveniles nearly linear, attenuate at the base, acute to rounded at the apex, 35–65(75) cm long, 2–5.5(7.5) cm wide, dark green above in life, brown above when dry, with small, brown or whitish, usually inconspicuous hydathodes, paler beneath; midrib scales not observed; principal veins 4.5–6(8) mm distant, closer in partially developed fronds; sori round, 2–3(4) mm in diam; sporangia with up to 12 persistent, linear, 1-celled hairs on the capsule; paraphyses (abortive sporangia) absent among the sporangia.

TYPE: Hacienda Mercedes, Entrada a Cayumba, forested slope to river, Prov. Huánuco, Peru, 1020 m, *Mexia* 8223 (UC; isotypes F, GH, MICH, MO).

RANGE AND HABITAT: Central Colombia; Peru to central Bolivia. Equally epiphytic or terrestrial, at altitudes from ca 700 to 1800 m.

This is the only species of the genus with involute—not plane—rhizome scales; the cells of the central band are only weakly clathrate and have occluded lumina.

ADDITIONAL SPECIMENS EXAMINED:

COLOMBIA: **Tolima:** El Líbano, around coffee farms, 1580 m, *García-Barriga* 12216 (US). **Valle:** Cartago, *André* 1954 (F, NY). **PERU:** **San Martín:** Hera near Moyobamba, 890 m, *Woytkowski* [4th U. C. Bot. Gard. Exped.] 35315 (UC). **Huánuco:** Muña, ca 2100 m, *Macbride* 3964 (F); Confluence of the Monzon and Huallaga Rivers, near Tingo María, 700 m, *Stork & Horton* [2nd U. C. Bot. Gard. Exped.] 9502 (F, UC, US). **Junín:** Huacapistana, 1812 m, *Coronado* 239 (GH, UC). **Ayacucho:** Aina, between Huanta and the Río Apurímac, 750–1000 m, *Killip & Smith* 22775 (NY, US). **Cuzco:** Quillabamba, Potrero, 1200 m, *Coronado* 128 (GH, UC). **BOLIVIA:** **La Paz:** North Yungas, Polo-Polo, near Coroico, 1100 m, *Buchtien* 3537 (F, GH, UC, US); South Yungas, Callisaya, 1700 m, *Cárdenas* 857 (GH).

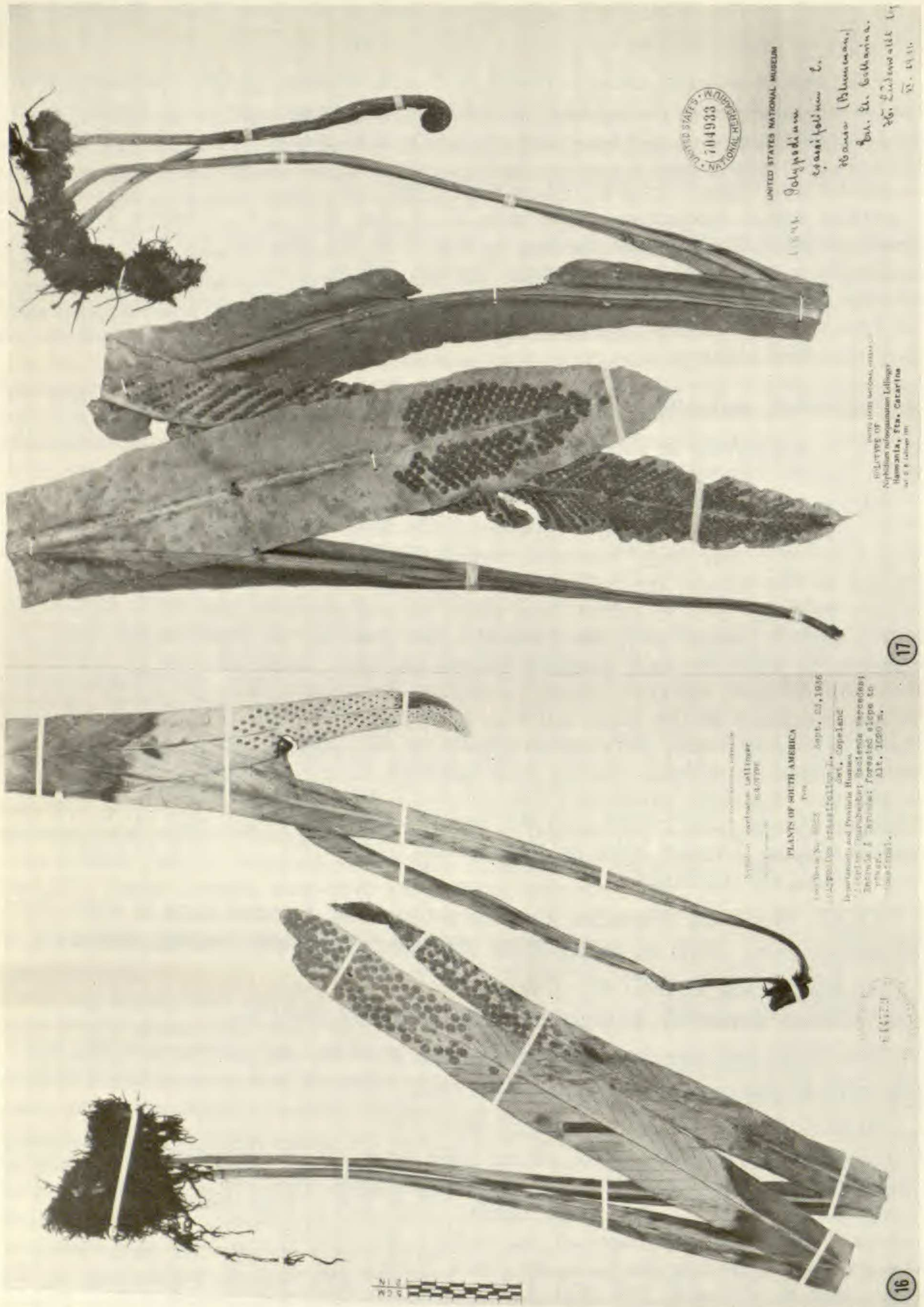


FIG. 16. Holotype of *Niphidium carinatum* (Mexia 8223, UC). FIG. 17. Holotype of *Niphidium rufosquamatum* (Luederwaldt 1841, US).

5. *Niphidium rufosquamatum* Lellinger, sp. nov.

Figs. 5 and 17.

Ab *N. crassifolium* in squamis rhizomatis concoloris rufis differt.

Rhizomes short-creeping, (8)10–13 mm in diam, not pruinose, phyllopodia ca 5 mm long, 5 mm wide; rhizome scales lanceolate-acuminate, ca 7–15 mm wide, plane throughout, always concolorous, rufocastaneous, weakly clathrate, the central cells more clathrate than the marginal ones, those above the base 2–3 × longer than wide, the margins repand to erose to toothed, the cells somewhat contorted. Stipes obsolete to 2 cm long, 3–5(6) mm in diam, adaxially sulcate. Laminae lanceolate to narrowly lanceolate, attenuate at the base into a narrow ala 2–4 mm wide, acute to rounded (sometimes with a small, acuminate tip) at the apex, (40)50–90(105) cm long, (4.5)5.5–10(11) cm wide, dark green above in life, brown and often glaucous above when dry, with inconspicuous, brown or white hydathodes, paler beneath; midrib scales ca 1.5 mm long, 0.4 mm wide, like those of the rhizome, caducous, seldom seen; principal sterile veins 5–10 mm distant, fertile veins 2.5–4(5) mm distant, closer in juvenile and partially developed fronds; sori round, 2–3 mm in diam; sporangia lacking hairs on the capsule; paraphyses (abortive sporangia) absent among the sporangia.

TYPE: Hammonia, Est. Santa Catarina, Brazil, *Luederwaldt 1841* (US; isotype NY).

RANGE AND HABITAT: Southeastern Brazil and northeastern Argentina. Epiphytic, rarely epipetric.

The only certain character for separating this species from *N. crassifolium* is the concolorous rhizome scales. The lack of hairs on the capsule and paraphyses among the sporangia are not so certain, and may also characterize occasional specimens of *N. crassifolium*. The fertile veins being closer together than the sterile ones is much more marked than in *N. crassifolium*, which often—but not always—has them spaced identically in mature specimens. But immature specimens of *N. crassifolium* and those in which blade expansion was halted prematurely may exhibit the same vein distance dimorphism that is typical of fully mature *N. rufopunctatum*.

ADDITIONAL SPECIMENS EXAMINED:

BRAZIL: Rio de Janeiro: Serra dos Orgãos, *Luetzelburg 6456* (MICH); Nova Friburgo, *Dusén 1920* (US). São Paulo: Alto do Serra, *Wacket 130* (NY); Campos do Jordão, *Leite 3634* (A, GH). Paraná: Pato Branco, *Reitz 4692* (HBR). Santa Catarina: *Luederwaldt 21987* (NY); Rio dos Bugres, Caçador, 800 m, *Reitz & Klein 12862* (HBR, US); Serra do Espigão, Papanduva, 100 m, *Reitz & Klein 12675* (HBR, US); Joinville, *Schmalz 94* (S-PA), 5 m, *Schmalz 75* (F); Passo Rio Canoas, Anita Garibaldi, 500 m, *Reitz & Klein 14764* (US); Ilha de Santa Catarina, Sertão da Lagoa, *Rohr CC1043* (HBR, US); Alto Matador, 700 m, *Reitz & Klein 6824* (US). Rio Grande do Sul: Estação São Salvador, Montenegro, *Sehnem 2065* (GH); São Leopoldo, *Rick 21* (GH), *Leite 1699* (GH), vicinity of São Leopoldo, *Eugenio 60* (NY); Morro das Pedras, *Reitz 178* (HBR, US); Santa Cruz, *Jürgens* [Ros. Fil. Austro-bras. Exs. 101] (GH, NY). ARGENTINA: Misiones: Gral. M. Belgrano, Route 14, *de la Sota et al. 6151* (LP, US).

6. *Niphidium mortonianum* Lellinger, sp. nov.

Figs. 6 and 18.

Polypodium crassifolium f. *helveola* Rosenst. Mém. Soc. Neuchat. 5: 45. 1913, *nom. nud.*
BASIS: "Savane de Bogotá et l'auberge de Tambo," Depto. Cundinamarca, Colombia, ca 2300 m, *Mayor 49* (S-PA Morton photo 20637 US).

Ab *N. crassifolium* in squamis rhizomatis leviter bicoloribus fuscis irregulariter dentatis non ciliatis, cellulis sinuatis vel contortis differt.



FIG. 18. Holotype of *Niphidium mortonianum* (Ewan 15602, US). FIG. 19. Holotype of *Niphidium macbridei* (Macbride & Featherstone 1234, US).

Rhizomes (5)6–10 mm in diam, not pruinose, phyllopodia 1–2 mm long, 2–6 mm wide; rhizome scales lanceolate-attenuate, ca 8–12 mm long, 2–3.5 mm wide, plane throughout, essentially concolorous, all but the marginal cells dark brown, strongly clathrate, those above the base 2–4(6) \times longer than wide, the margins pale brown, distinctly irregularly toothed, the teeth up to 0.25 mm wide at the base, obsolete toward the apex, the cells contorted. Stipes (3)7–14 cm long, 2–4(5) mm in diam, adaxially flattened or sulcate. Laminae linear-lanceolate, the juveniles almost linear and with obsolete stipes, acuminate to attenuate at the base, acuminate, acute, or occasionally rounded at the apex, 35–75(100) cm long, (1.75)3–7.5 cm wide, dark green above in life, brown above when dry with inconspicuous brown or rarely whitish hydathodes, not paler beneath; midrib scales up to 2 mm long, 1 mm wide, like those of the rhizome, caducous, seldom seen; principal veins 3–6 mm distant, closer towards the apex than the base of the lamina in both juvenile and adult fronds; sori round, 2–3.5 mm in diam; sporangia occasionally with linear, 2-celled hairs on the capsule; apex of sporangial pedicels swollen and reddish; paraphyses (abortive sporangia) rare among the sporangia.

TYPE: Quebrada at end of Avenida 20 Julio trolley line, Bogotá, Depto. Cundinamarca, Colombia, 2640 m, *Ewan 15602* (US).

RANGE AND HABITAT: Northeastern Venezuela (Monagas); Northwestern Venezuela to southern Colombia. Epipetric, on stone walls, and terrestrial, but rarely epiphytic, at altitudes of 1500–2200 m in eastern Venezuela and 2400–2800 m elsewhere in the range.

ADDITIONAL SPECIMENS EXAMINED:

VENEZUELA: Monagas: Cerro Negro above La Sabana de las Piedras, NW of Caripe, 1500–2180 m, *Steyermark 62053* (F, US). **Mérida:** Near Colonia Tovar, *Fendler 222* (GH, MO, US); Mucurubá, 2600 m, *Gehriger 279* (F, NY, US). **Distr. Fed.:** "Folda de El Avila," *Ll. Williams 10936* (F). **COLOMBIA: Norte de Santander:** Hoya de Samaria, Cordillera Oriental, 2000–2100 m, *Cuatrecasas, Schultes & Smith 12780* (F, GH). **Cundinamarca:** Facatativa, *Ariste-Joseph A188* (US); On road to Usme ca 5 km SW of Bogotá, ca 2800 m, *Smith & Idrobo 1318* (US); Railroad station at Tablanca, 40 km WNW of Bogotá, 7000–7400 ft, *Little & Little 9145* (US); Salto de Tequendama, 2500 m, *Cuatrecasas 145* (F); Vicinity of El Salto, 8100–8300 ft, *Little & Little 7869* (US); Sueva Valley, 9 km W of Junín, 2400 m, *Grant 9094* (US); 7 km NW of Sibate, 2530 m, *Tryon & Tryon 6090* (GH); Bosque del Acueducto, Usaquén, *Murillo & Rico 59* (NY); "El Recreo," Santandercito, *Murillo & Fayad 122* (NY); Chiquinquirá, 2500 m, *von Sneidern 5843* (GH, MICH, MO); Along the Río Blanco SE of Guasca, vicinity of Los Andes, 9300 ft, *Core 574* (US); S end, E side of Suba Hill, near Bogotá, *Schiefer 567* (GH); In the mountains near Bogotá, *Holton 33* (NY). **Antioquia:** Boquerón, *Daniel 623* (F). **Santander:** Vicinity of Charta, 2600 m, *Killip & Smith 18959* (GH, NY). **Nariño:** W slope of Volcán Doña Juana, 2800 m, *Ewan 16598* (US), **Unlocalized:** *Moritz* (GH); *Mutis 3212* (F, US).

7. *Niphidium macbridei* Lellinger, sp. nov.

Figs. 7, 13 and 19.

Ab *N. crassifolio* in squamis rhizomatis pallidis irregulariter dentatis sparse ciliatis, cellulis isodiametris differt.

Rhizomes creeping, 5–10 mm in diam, pruinose, phyllopodia 2–5 mm long, 3.5–5 mm wide; rhizome scales broadly lanceolate-acuminate, with a long, uniseriate, filiform to contorted tip, ca 6–8(10) mm long, 2.5–3 mm wide, plane throughout, strongly bicolorous, the central band blackish, the cells strongly clathrate, the lumina very large and clear, those above the base 1–1.5 \times longer than wide, the margins pale tan, irregularly toothed or ciliate, up to 0.5 mm wide at the base,

0.25 mm wide toward the apex, the cells near the margins contorted. Stipes (3)7–13(15) cm long, 2.5–4.5 mm in diam, adaxially sulcate. Laminae usually narrowly lanceolate, attenuate at the base, acute but slightly rounded at the apex (juveniles rounded at the apex), (20)30–50(70) cm long, (2.5)3.5–6.5 cm wide, pale green above in life, pale green above and not glaucous when dry, with inconspicuous, whitish hydathodes, not paler beneath; midrib scales up to 3 mm long, 0.5 mm wide, like those of the rhizome but concolorous, caducous, seldom seen; principal sterile veins 5–6.5 mm distant, fertile ones (2.5)4–6.5 mm distant, closer in juvenile and partially developed fronds; sori round, 2.5–3(4) mm in diam; sporangia lacking hairs on the capsule; paraphyses (abortive sporangia) absent among the sporangia.

TYPE: Yanahuanca, Depto. Junín, Peru, ca 10000 ft, *Macbride & Featherstone 1234* (US; isotypes F, GH).

RANGE AND HABITAT: Andes of Central Peru, at altitudes of 2500 to 3600 m. Epipetric.

The range and habitat of this species, which has inconspicuous hydathodes in 2(3) series, overlap those of *N. albopunctatissimum*, which has usually conspicuous hydathodes in 3(4) series. *Niphidium macbridei* is not paler below than above, as *N. albopunctatissimum* is.

ADDITIONAL SPECIMENS EXAMINED:

PERU: Huánuco: Panao, ca 2500 m, *Asplund 13619* (US); Between Cuzco and Machupichu, 20 May 1958, *Guarrera* (LP). Junín: Along main road below Palca, 2800 m, *Correll & Smith P-760* (GH). Apurímac: Trail between Huancarama and Abancay, 3600 m, *West* [1st U. C. Bot. Gard. Exped.] 3765 (MICH, UC). Cuzco: Ollantaytambo, ca 3000 m, *Cook & Gilbert 544* (US); Urubamba, *Soukup 158* (GH).

8. *Niphidium longifolium* (Cav.) Morton & Lellinger, Amer. Fern J. 61: 39, t. 8, f. 1–2. 1971.

Fig. 8.

Polypodium longifolium Cav. Descr. 245. 1802. TYPE: Pelileo, near Mount Tungurahua, Ecuador, *Née* (MA seen by Christensen).

Polypodium americanum Hook. Sp. Fil. 5: 54. 1864. SYNTYPES: Cuenca, Ecuador, Jameson, and Baños, Ecuador, *Spruce 5248* (both syntypes presumably K, not seen).

Niphidium americanum (Hook.) J. Smith, Hist. Fil. 99. 1875.

Niphobolus americanus (Hook.) Diels in Engl. & Prantl, Nat. Pflanzenfam. 1(4): 325. 1899.

Cyclophorus americanus (Hook.) C. Chr. Ind. Fil. 198. 1905.

Cyclophorus longifolius (Cav.) C. Chr. Dansk Bot. Ark. 9(3): 11. 1937.

Rhizomes long-creeping, 5–12 mm in diam, pruinose, articulate to the rhizome but without phyllopodia; rhizome scales lanceolate-attenuate, ca 7–10 mm long, 1.5–2 mm wide, plane throughout, essentially concolorous, the central area reddish brown, the cells weakly clathrate, those above the base 1–3(4) × longer than wide, the margins paler and less clathrate, ciliate-toothed, the cells contorted, the cilia up to 1 mm long, the cells elongate toward the apex. Stipes (2)5–15(18) cm long, 1.5–2.5(3) mm in diam, adaxially sulcate. Laminae linear-lanceolate, the margins usually revolute at maturity, attenuate at base and apex, 35–60(65) cm long, 1–2.5(3) cm wide, dark yellow-green to bluish green above in life, greenish or brownish when dry, with small, usually conspicuous, dark brown or whitish hydathodes, densely scaly beneath on the lamina but not the midrib; laminar scales up to 4 mm long, 3 mm wide, like those of the rhizome except the central, clathrate portion reduced and the long, tangled, marginal cilia longer, always persistent; principal veins 4–6 mm distant, closer in juvenile and partially developed fronds; sori slightly to definitely elongate transversely be-

tween the veins, 1.5–3.5 mm long; sporangia rarely with up to ca 4 deciduous, linear, 1- or 2-celled hairs on the capsule; paraphyses (abortive sporangia) rare among the sporangia.

RANGE AND HABITAT: Andes mountains of Ecuador. Epipetric at altitudes of 2300–2900 m.

This species is the only one of the genus with the laminae beneath copiously and persistently scaly. Because the extremely long cilia on the scales slightly resemble the truly stellate hairs of *Pyrrosia* (formerly called *Cyclophorus*), this species has been put in that genus, but it is not at all allied (see Morton, C. V. and D. B. Lellinger, Amer. Fern J. **61**: 37–39. 1971). An infusion of the rhizomes is used as a purgative in intestinal infections and disorders (Ecuador, *Camp E-2487*).

ADDITIONAL SPECIMENS EXAMINED:

ECUADOR: **Carchí:** Between Cunquer and Cuesaca, 2650–2900 m, *Acosta Solís 10458* (F). **Imbabura:** Hacienda La Victoria, near Ibarra, 2350 m, *Mexia 7427* (US). **Imbabura-Pichincha:** Otavalo to Malchinguí, 2400–3000 m, *Hitchcock 20817* (US). **Pichincha:** At Cotocollas, *Mille 402* (US); near Cotocollas, 2750 m, *Mille* in 1920 (US); Quito, *Sodirol* (US). **Tungurahua:** Around Quero, Pelileo, etc. in the high mountain valley of Ambato, 1900–2700 m, *Lehmann 5036* (US); Between Pasa and San Fernando, 3000–3270 m, *Acosta Solís 8717* (F); Road from Ambato to Pillaro, ca 2700 m, *Scolnik & Chico 1580* (US); Zamanga at Ambato, 2700 m, *Böcher, Hjerting & Rahn 88* (US); On road to Ambato, 7 km from Baños, *Correll E-309* (US). **Chimborazo:** Chambo, *Asplund 6000* (US); Río Chambo, 2800 m, *Schimpff* (F, US); Riobamba, July 1912, *Mille* (US). **Cañar:** Near the village of San Marcos, 5–8 km NE of Azogues, *Camp E-2487* (F, US). **Azuay:** Around Cuenca, 2400–2900 m, *Lehmann 5729* (F, US); Vicinity of Cuenca, *Rose, Pachano & Rose 22816* (US); Cuenca, 2500 m, *Penland & Summers 1041* (US); Near Paccha, 2500 m, *Haught 3340* (US); Valley of the Río Tarqui a few km S of Cuenca, ca 2500 m, *Giler 59* (US).

9. *Niphidium vittaria* (Mett.) Lellinger, comb. nov.

Figs. 9 and 11.

Polypodium vittaria Mett. Fil. Lechl. **1**: 8. 1856. TYPE: "Ad muros," Tabina, Prov. Puno, Peru, July 1854, *Lechler Pl. Peruan. 2039* (B-Hb. Mett. not seen Berlin photo 3504/2 US; isotypes L, W).

Rhizomes long-creeping, (2.5)3–5(6) mm in diam, not pruinose, phyllopodia 3–5 mm long, 1.5–3 mm wide; rhizome scales lanceolate-acuminate, patent, ca 4–8 mm long, 2–3 mm wide, plane throughout, strongly bicolorous, the central band dark reddish brown to black, the cells strongly clathrate, those above the base 1(2) × longer than wide, the margins nearly stramineous to pale tan, erose or slightly irregularly ciliate, up to 0.5 mm wide at the base, 0.05 mm wide toward the apex, the cells not elongate toward the apex. Stipes (3)5–10 cm long, 1–2 mm in diam, adaxially sulcate. Laminae linear-lanceolate, attenuate at the base (acute in juveniles), attenuate or rarely rounded at the apex, 30–50 cm long, 1.5–2(2.4) cm wide, probably pale green above in life, pale green or pale brown when dry, with black or white-encrusted hydathodes, not paler beneath; midrib scales up to 3 mm long, 1 mm wide, like those of the rhizome, persistent; principal sterile veins 5–6.5 mm distant, fertile ones 3.5–5 mm distant; sori round or rarely slightly elongate transversely in the largest specimens, 1.5–2.5(3.5) mm in diam; sporangia very rarely with up to 5 linear or slightly clavate (1)2-celled hairs on the capsule; paraphyses (abortive sporangia) rare among the sporangia.

RANGE AND HABITAT: Eastern Andes of central and southern Peru. Epipetric or occasionally epiphytic, at altitudes of (1200) 1500–2600 m.

ADDITIONAL SPECIMENS EXAMINED:

PERU: Huánuco: Muña, ca 7000 ft, *Macbride* 3964 (US). **Junín:** Yaupi, 1580 m, *Woytkowski* 6496 (MO, US). **Cuzco:** Potrero, 8 km W of Quillabamba, 1200 m, *Tryon & Tryon* 5392 (F, GH, UC); Riberta del Río Urubamba, 2350 m, *Angulo* 1755 (GH). **Puno:** Below Ollachea, 2520 m, *Vargas C.* 6905 (UC).

10. *Niphidium anocarpos* (Kunze) Lellinger, comb. nov.

Figs. 10 and 12.

Polypodium anocarpos Kunze, *Linnaea* 9: 40. 1834. TYPE: "[In] truncis arborum ad Pampayaco," Depto. Huánuco, Peru, *Poeppig* 1128 (LZ, destroyed; lectotype, chosen here: the isotype at B-Hb. Mett. not seen, Berlin photo 1504/5 US fragment US).

Polypodium acrosorum Kunze, *Linnaea* 9: 39. 1834. TYPE: "In truncis arbor. vetustis sylvar. fl. Peruv. ad Pampayaco," Depto. Huánuco, Peru, July 1829, *Poeppig* 1112 (LZ, destroyed; lectotype, chosen here: the isotype at HBG, photo US; isotypes BR, HBG, L, LE). The isotypes I have seen seem to be the same collection, although those at BR, HBG, and L are dated 1830, presumably erroneously, for they are an exact match for the one dated 1829. The specimen at L is labeled "*Polypodium anocarpos*." All but the one at L lack rhizomes; it alone is positively identifiable as *P. anocarpos*, principally through two badly eroded scales attached to the stipe base.

Phymatodes acrosora (Kunze) Presl, *Tent. Pterid.* 197. 1836.

Rhizomes long-creeping, (2)3–5(6) mm in diam, not pruinose, phyllopodia 2–4(5) mm long, 2–3 mm wide; rhizome scales broadly lanceolate, appressed, ca 2–2.5 mm long, 1.5–2 mm wide, plane throughout, strongly bicolorous, the central band black, the cells strongly clathrate with small, occluded lumina, those above the base 1(2) \times longer than wide, the margins reddish brown to pale tan, fimbriate, usually erose in age, up to 0.5 mm wide at the base, 0.1 mm wide toward the apex, the cells not elongate toward the apex. Stipes (2)4–13 cm long, 1.5–2 mm in diam, adaxially sulcate. Laminae linear-lanceolate, attenuate or acuminate at the base, attenuate at the apex, (25)50–75 cm long, (1)1.5–3.5(4.5) cm wide, pale to dark green above in life, brown and sometimes glaucous above when dry, with brown, inconspicuous hydathodes, usually paler beneath; midrib scales up to 1.8 mm long, 0.8 mm wide, like those of the rhizome except the margins narrower and less fimbriate, persistent; principal veins 4–5.5 mm distant; sori round, 1.5–2.5(3) mm in diam; sporangia with up to 5 persistent, linear, 1-celled hairs on the capsule; paraphyses (abortive sporangia) rare among the sporangia.

RANGE AND HABITAT: Eastern Andes of Peru and Bolivia. Epiphytic or occasionally epipetric at altitudes of (1100)1400–3900 m.

The epithet *acrosorum* seems never to have been used other than by Kunze, and so I choose to adopt the epithet *anocarpos*, which occasionally is seen on herbarium specimens. It is surprising to find that Kunze named the same species twice in a single publication, for he rarely fell into such inaccuracy. In this case, the type of *P. acrosorum* has somewhat aberrant, curved-caudate fronds ("apice in acumen curvum"), which led Kunze to believe it was different from his *P. anocarpos*. The other characters adduced by Kunze are insubstantial, and the rhizome scales are apparently identical.

ADDITIONAL SPECIMENS EXAMINED:

PERU: Huánuco: Muña, ca 7000 ft, *Macbride* 3975 (F, US), 4041 (F, US); Tambo de Vaca, ca 13000 ft, *Bryan* 675 (US). **BOLIVIA: La Paz:** Hacienda Carano on the road to Tipuani, 1400 m, *Buchtien* 7076 (NY, UC); Polo-Polo near Coroico, 1100 m, *Buchtien* [Ros. Fil. Bol. Exs. 125] 3528 (F, S-PA, UC, US); Coroico, *Bang* 2447 (NY, US). **Santa Cruz:** Samaipata, 1800 m, *Steinbach* 3758 (GH); Comarapa, Yungas de San Mateo, 2800 m, *Steinbach* 8442 (F, MO), 2900 m, *Steinbach* 8471 (GH), 8547 (MO).

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